

OBSERVATIONS ON SOME AUSTRALIAN FOREST INSECTS.

19. ADDITIONAL INFORMATION ON THE GENUS GLYCASPIS (HOMOPTERA: PSYLLIDAE);
ERECTION OF A NEW SUBGENUS AND DESCRIPTIONS OF SIX NEW SPECIES.

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(Twenty-seven Text-figures.)

[Read 24th June, 1964.]

Synopsis.

The subgenus *Boreioglycaspis* nov. is erected within the genus *Glycaspis* Taylor 1960 to receive those species with morphological characteristics indicative of a more recent evolutionary sequence than that of specimens in the subgenera *Glycaspis* and *Alloglycaspis*.

Six new species from New South Wales, Queensland, Penang Id. and North Borneo are described, and their apparent evolutionary sequence within the genus is discussed. *Epipsylla forcipata* Crawford 1917 from the Philippine Is. is placed in the new subgenus, and a male specimen of the type series is designated as lectotype.

The genus *Glycaspis* apparently originated in Australia with the leaf-gall formers of the subgenus *Glycaspis* occurring on those *Eucalyptus* spp. placed in the Renantherae by Blakely (1955), and the specimens examined and described in this paper are considered to represent a northern evolutionary extension of the genus. The species of *Boreioglycaspis* apparently diverged from the subgenus *Alloglycaspis* (species of which occur on *Eucalyptus* spp. other than Renantherae) to a *Melaleuca* sp. host-association.

No lerp-forming habits are recorded for any of the species in the new subgenus.

INTRODUCTION.

The genus *Glycaspis* was discussed in a previous paper (Moore, 1961a) and, sequential to the publication of that paper, several psyllid specimens which were in the collections of the Bernice P. Bishop Museum, Hawaii, and the United States National Museum, Washington, and which appeared similar to species of *Glycaspis*, were made available for examination.

Among the specimens received from the B. P. Bishop Museum was one which bore label data corresponding to data on labels of specimens in the type series of *Epipsylla forcipata* in the U.S. National Museum and yet agreeing in certain morphological characteristics with those previously given for species of the genus *Glycaspis*. Specimens of the type series of *E. forcipata* were then examined and compared with specimens received from the B. P. Bishop Museum.

The Genus GLYCASPIS Taylor 1960.

Subgenus ALLOGLYCASPIS Moore 1961.

Synonymy: *Psylla* Dobson 1851; *Spondylia* Schwarz 1898; *Spondylia* Froggatt 1900; *Epipsylla* Crawford 1917; *Spondylia* Tuthill & Taylor 1955.

Subgenus BOREIOGLYCASPIS, nov.

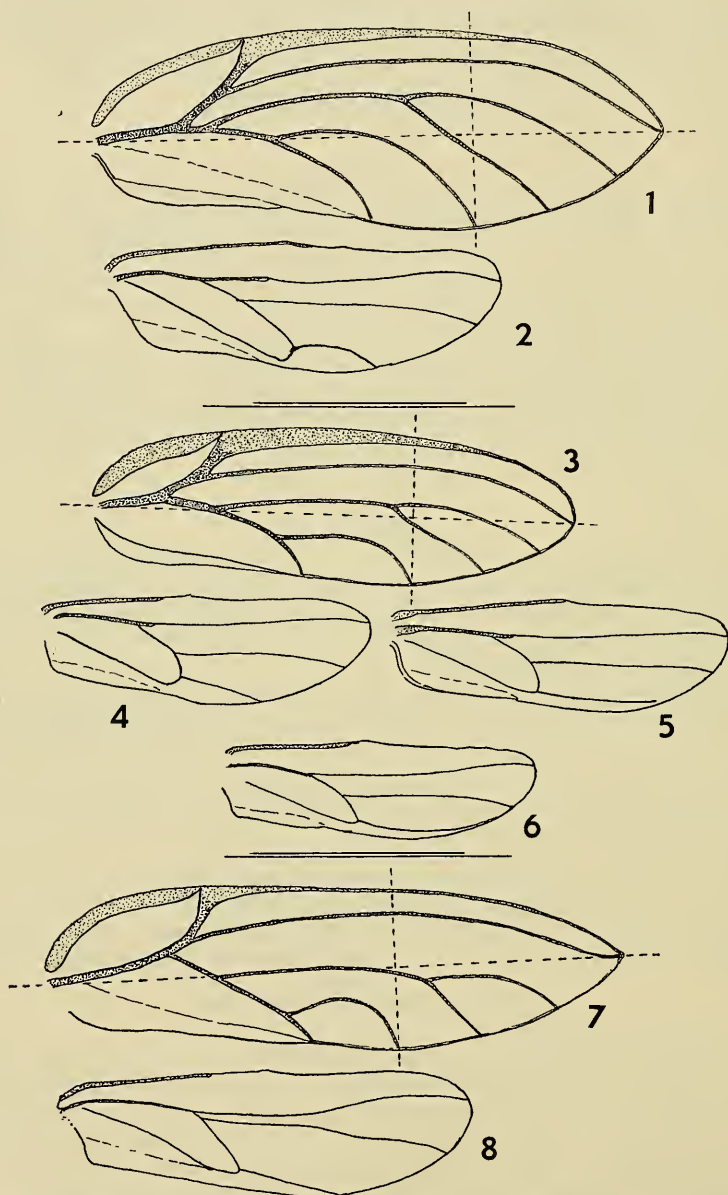
(Greek: *voreia* = northern.)*Type species: Glycaspis (Boreioglycaspis) melaleucae*, sp. nov. (here designated).*Type locality:* 12½ miles along the Gwydir Highway west of Grafton, N.S.W.

Species within the subgenus *Boreioglycaspis* may be separated from species in the subgenera *Glycaspis* and *Alloglycaspis* by the following morphological characteristics:

1. Proximal angle of cell M of forewing commencing beyond the projected termination of Cu_1 at the posterior border of the wing* (Text-figs 7, 15-20, 23).

* The commencement of the proximal angle of cell M in relation to the termination of Cu_1 at the posterior wing border has been determined by the short axis of the wing projected through the terminal point of Cu_1 and described at 90° to the long axis, the latter passing through the proximal point of the combined basal venation and the distal terminal point of vein Rs at apex of wing (Text-figs 1, 3, 7).

2. Points of origin of veins M and Rs of hindwing close together (Text-figs 8, 21, 24).
3. Meta-tarsal pad usually smaller, approx. $\frac{1}{4}$ to $\frac{1}{3}$ the length of tibia (Text-fig. 10).
4. Tibia approx. $\frac{2}{3}$ of, to equal in length with, femur† (Text-fig. 10).



Figs 1-8. Wings typical of (1, 2) *Glycaspis* (*Glycaspis*) spp., (3-6) *Glycaspis* (*Alloglycaspis*) spp., and (7, 8) *Glycaspis* (*Boreioglycaspis*) spp.

† Taylor (1960), when defining the principal morphological characters for the genus *Glycaspis*, stated "metatibia shorter than femur" although Tuthill & Taylor (1955) stated "metatibia shorter than or about equal to femur". Considering the species now placed in *Glycaspis* (*Boreioglycaspis*), the definition of this particular characteristic by Tuthill & Taylor is therefore the interpretation which should be followed.

5. Metatibia slightly enlarged apically, the black distal spurs not emanating from a lateral protuberance as in the other subgenera (Text-figs 9, 10).

6. Male aedeagus two-jointed (Text-figs 25, 26).

7. Distal segment of male proctiger about equal in length to proximal segment (Text-figs 13, 14).

8. Claspers with dark strong prominent pegs on the internal faces (Text-figs 25, 26).

9. The pointed upper and lower plates of the female genitalia each terminating in a small distal prominence bearing numerous setae (Text-fig. 11).

Genital processes may be longer or shorter than width of the vertex, and ocular sclerites may be reduced or very prominent.

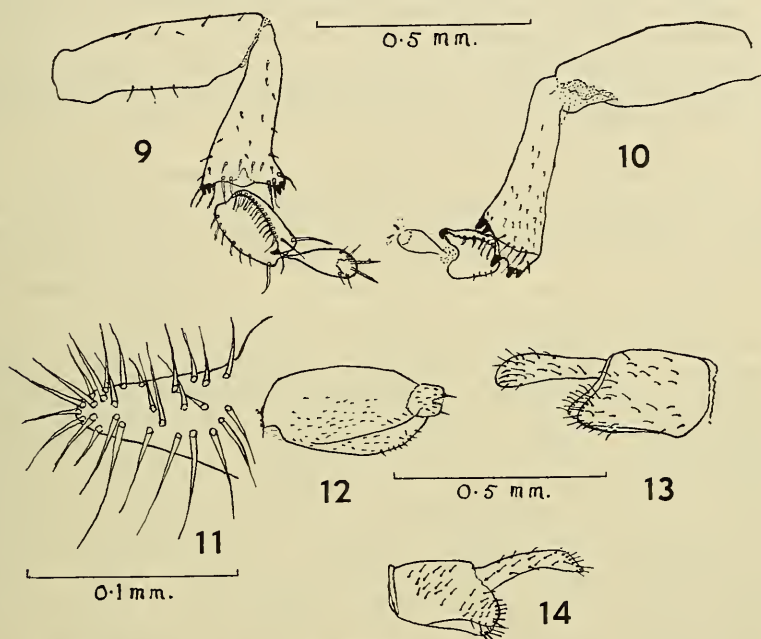


Fig. 9. Meta-femur, tibia and tarsus typical of *Glycaspis* and *Alloglycaspis* spp.

Fig. 10. Meta-femur, tibia and tarsus of *Glycaspis* (*Boreioglycaspis*) *australiensis*, sp. nov.

Fig. 11. Apical tip of female upper genital plate of *G. (B.) australiensis*, sp. nov. (setae to scale).

Fig. 12. Male proctiger typical of species in subgenera *Glycaspis* and *Alloglycaspis*.

Figs 13, 14. Male proctiger of (13) lectotype, (*G. (B.) forcipata* (Crawford)); (14) *G. (B.) melaleucae*, sp. nov.

DESCRIPTIONS.

GLYCASPIS (BOREIOGLYCASPIS) MELALEUCAE, sp. nov.

General colour (in alcohol): Pale yellow sometimes suffused red, with grey and black markings.

Male: Head: width 0.61 mm.; vertex: along suture 0.22 mm., width 0.29 mm., yellow, with posterior and anterior border black, palest on anterior edge; genal processes: length 0.24 mm., cream, with small lateral area near tips suffused pale grey; ventral border of antennal foveae black; antennae: length 0.85 mm., segs. 1 to 3 suffused pale grey, segs. 4 to 9 with distal one-quarter grey and darkest on seg. 9, seg. 10 black. Pronotum: width 0.46 mm., pale yellow, lateral prominences narrowly bordered black posteriorly. Prescutum: pale yellow, antero-lateral edges below pronotum and median and lateral portions of posterior edge, pale grey. Scutum: pale yellow, with posterior edge narrowly marked pale grey. Scutellum and metascutellum: pale yellow. Metanotum: pale yellow, with pale grey suffusion each side of meta-

scutellum. Post-metanotum: pale yellow, with small dark grey lateral wedge-shaped area produced posteriorly. Abdomen: pale yellow, suffused grey laterally, with a dark grey spot surrounding each spiracle, segs. 2 to 5 with a wide anterior transverse pale grey stripe; claspers and aedeagus as in Text-figure 25, pale yellow, distal segment of proctiger slightly longer than proximal seg. (Text-fig. 14). Length of 2-jointed aedeagus (16 specimens): extremes of distal portion 0.050 mm. to 0.063 mm.; of proximal portion 0.182 mm. to 0.209 mm.; of total length 0.232 mm. to 0.270 mm. Forewing: length 2.15 mm., width 0.63 mm., venation pale yellow brown (Text-fig. 15). Hindwings: venation similar to Text-figure 21. Legs: anterior femora marked with black along inner surface near distal joint, anterior and median tibiae with dark grey spot near proximal joint, metatibia shorter than femur, proximal seg. of metatarsus approx. $\frac{3}{8}$ length of tibia. The black pegs on the internal face of each clasper are variable in number in *G. melaleucæ*.

Female: General colour as for the male, but dark markings more intense. Anal aperture bordered black anteriorly and postero-laterally, upper and lower plates of genital seg. pointed, and upper plate projecting beyond lower plate.

Host-plant: *Melaleuca quinquenervia* (Cav.) S. T. Blake.

Type locality: Grafton, N.S.W., 12 $\frac{1}{4}$ miles west along Gwydir Highway.

Types: Holotype ♂ and allotype ♀ on slides labelled "Grafton, N.S.W., 11 i 1964, K. M. Moore. On *Melaleuca quinquenervia*", in the collection of The Australian Museum, Sydney, New South Wales. Paratypes: (on slides) 3 ♂♂ labelled as above, to The Australian Museum; 1 ♂ and 1 ♀ labelled as above to the United States National Museum, Washington, D.C., and 1 ♂ to the B. P. Bishop Museum, Honolulu, Hawaii. 1 ♂ labelled "Forster, N.S.W., 15 i 1964, K. M. Moore. (1 to 2 miles south of town). On *M. quinquenervia*"; 6 ♂♂ labelled "Palm Beach, Queensland, 12 i 1964, K. M. Moore. (100 yards west of Pacific Highway). On *Melaleuca quinquenervia*"; 3 ♂♂ and 1 ♀ labelled "Budgewoi, N.S.W., 27 xii 1963, K. M. Moore. ($\frac{1}{4}$ mile east of town). On *Melaleuca quinquenervia*"; all to The Australian Museum. (In alcohol) 7 ♂♂ and 20 ♀♀ and nymphs labelled "Grafton, N.S.W., 11 i 1964, K. M. Moore. On *Melaleuca quinquenervia*"; 1 ♂, 1 ♀ labelled "Budgewoi, N.S.W., 27 xii 1963, K. M. Moore. On *Melaleuca quinquenervia*"; 1 ♀ labelled "Tacoma, N.S.W., 14 ii 1964, K. M. Moore. On *Melaleuca quinquenervia*"; 1 ♀ labelled "Woodburn, N.S.W., 11 i 1964, K. M. Moore. (4 miles south along Pacific Highway). On *Melaleuca quinquenervia*"; 3 ♀♀ labelled "Budgewoi, N.S.W., 15 i 1964, K. M. Moore. On *Melaleuca quinquenervia*"; 11 ♀♀ labelled "Palm Beach, Queensland, 12 i 1964, K. M. Moore. On *Melaleuca quinquenervia*"; all to The Australian Museum.

Notes: Nymphs and adults of this species feed among the foliage of young tips of the host plant, and there was no evidence of lerp formation by nymphs. Known distribution of this species is from Tacoma (Tuggerah Lakes), N.S.W., to Palm Beach, Queensland.

GLYCASPIS (BOREIOGLYCASPIS) PALUDIS, sp. nov.

(*L. paludis* = of a marsh. Referring to the collection locality.)

General colour (in alcohol): Yellow with grey and black markings. Dark markings between venation at posterior edge of forewings.

Female: Head: width 0.63 mm.; vertex: along suture 0.24 mm., width 0.34 mm., yellow suffused red, with posterior border black continuing to behind eyes, lateral borders lightly marked black, and a small grey spot in each discal depression; genal processes: length 0.24 mm., suffused dark grey to black, ventral border of antennal foveae and adjoining area black; antennae: length 0.76 mm., segs. 1 to 8 pale cream, seg. 9 suffused dark grey, seg. 10 black, segs. 4, 6 and 8 suffused grey distally. Pronotum: width 0.57 mm., yellow suffused red, prominences pale cream, a pale grey longitudinal mark each side at half the distance from median area to lateral edges. Prescutum: yellow suffused red with lateral edges suffused grey. Scutum: yellow with postero-lateral edges suffused dark grey, two orange longitudinal stripes each side for the length of scutum. Scutellum and meta-scutellum: pale yellow. Metanotum:

yellow with edges suffused grey, a grey area at each postero-lateral angle of scutellum, and a larger grey area on each postero-lateral edge. Post-metanotum: yellow with small dark grey lateral wedge-shaped area produced posteriorly. Abdomen: yellow, seg. 1 with yellow suffused red central rectangular area surrounded with grey which is produced at posterior angles on to the anterior edge of seg. 2; seg. 2 with anterior edge pale grey and segs. 2 to 5 each with a broad dorsal transverse grey stripe; a dark grey spot surrounding each spiracle. Anal aperture bordered black except posteriorly. Upper plate of genital seg. yellow and projecting beyond lower plate which is black. A prominent black lateral stripe extends from below the lateral prominence of pronotum to the antero-lateral edge of post-metanotum. Forewing (Text-fig. 16): length 2.56 mm., width 0.73 mm., a narrow area between venation along posterior edge suffused grey, venation pale yellow suffused brown. Hindwings: venation similar to Text-figure 8. Ventral. Legs: anterior femora marked grey along inner surface, anterior and median femora pale grey near proximal joint, meta-coxae with a grey area near each postero-lateral angle. Abdomen: seg. 1 with a dark grey area each side on the anterior edge, segs. 2 to 4 each with a dark grey spot near anterior edge and diffused laterally toward spiracle.

Host-plant: *Melaleuca quinquenervia*.

Type locality: Palm Beach, Queensland, 100 yards west of Pacific Highway.

Types: Holotype ♀ on slide labelled "Palm Beach, Queensland, 12 i 1964, K. M. Moore. On *Melaleuca quinquenervia*"; paratype: 1 ♀ in alcohol, labelled as above; both to The Australian Museum.

GLYCASPIS (BOREIOGLYCASPIS) AUSTRALIENSIS, sp. nov.

General colour (dried specimen): pale brown suffused red.

Female. Head: width 0.73 mm.; vertex: along suture 0.34 mm., width 0.39 mm., red-brown; discal depressions pronounced; genal processes: length 0.39 mm., red, slightly divergent from $\frac{1}{4}$ of their length from base; antennae: length 1.63 mm., segs. 1 and 2 red, seg. 3 pale brown suffused pink, segs. 4 to 8 pale brown darkening distally to seg. 8 which is dark brown, segs. 9 and 10 black. Pronotum: width 0.57 mm., median area pale brown, lateral areas red. Prescutum: pale brown, median area palest, and lateral ridges suffused black; two anterior median darker brown marks produced to below pronotum. Scutum: wide median longitudinal area creamy brown, lateral areas brown suffused red. Scutellum and meta-scutellum: pale brown with area between brown; a black area each side of meta-scutellum, remainder brown suffused red. Post-metanotum: red-brown marked laterally with black. Abdomen: red, with a wide black transverse band on segs. 1 to 3 and black lateral areas on seg. 4; anal aperture surrounded with black, but narrowest posteriorly; upper genital plate brown. Legs: metatibia and femur equal in length; proximal seg. of meta-tarsus approx. $\frac{1}{4}$ length of tibia. Forewing (Text-fig. 17) with brown areas, length 3.41 mm., width 1.00 mm. Hindwing: venation as in Text-figure 8. Ventral: pale brown.

Host-plant: Not known.

Type locality: Coolangatta, on the New South Wales-Queensland border.

Types: Holotype female (dried specimen) labelled "Coolangata, Queensland, Coll. F. Muir, viii 1919", deposited in the collection of the Bernice P. Bishop Museum, Hawaii. Paratypes: 1 ♀ on slide, with same label data, in the collection of the B. P. Bishop Museum; 1 ♀ (dried specimen) with same label data, in the collection of The Australian Museum.

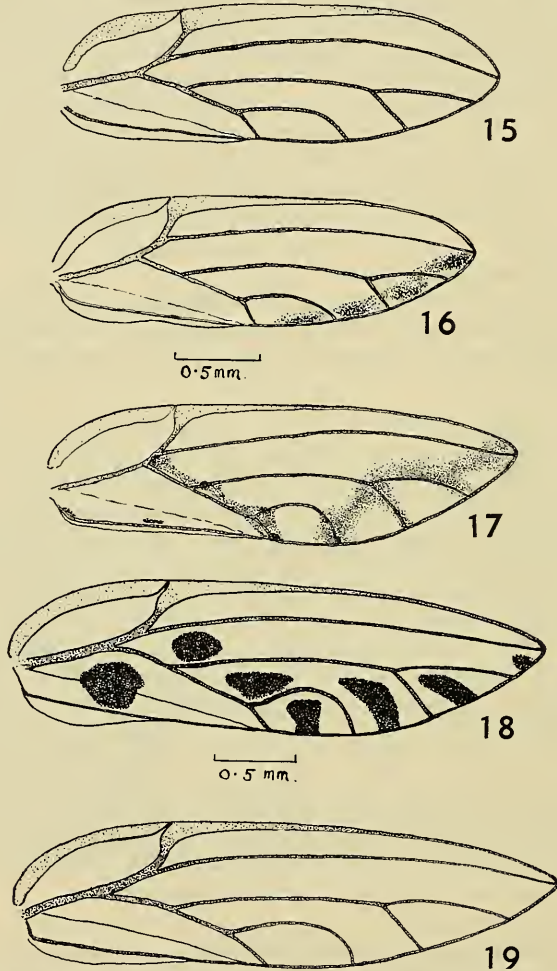
GLYCASPIS (BOREIOGLYCASPIS) POLYMELASMA, sp. nov.

(Gr. *poly* = many; *melasma* = a black spot. Referring to the coloration of the species.)

General colour (dried specimen): Yellow with black areas.

Female. Head: width 0.73 mm., eyes black; vertex: along suture 0.32 mm., width 0.39 mm., shiny black, discal depressions moderately pronounced, ocular sclerites narrow and very pronounced, yellow; genal processes: length 0.51 mm., dark brown,

paler distally and with a yellow dorsal area from bases to half their length; antennae: length 1.54 mm., segs. 1 and 2 yellow, segs. 3 to 8 pale brown, segs. 9 and 10 black. Pronotum: width 0.61 mm., yellow. Prescutum: yellow with mesopleura black. Scutum: bordered yellow, widest on the anterior border; remainder dark brown, to almost black laterally. Meta-pleura black. Scutellum, meta-scutellum and meta-notum yellow. Post-metanotum: yellow with a large dark brown dorso-lateral spot each side. Abdomen: segs. 1 and 2 yellow, seg. 3 with a small dark brown lateral spot each side, segs. 4 and 5



Figs 15-19. Forewing of (15) *G. (B.) melaleucae*, sp. nov.; (16) *G. (B.) paludis*, sp. nov.; (17) *G. (B.) australiensis*, sp. nov.; (18) *G. (B.) polymelasma*, sp. nov.; (19) *G. (B.) borneensis*, sp. nov.

dark brown, anal aperture bordered black anteriorly and extending laterally, genital segs. yellow, suffused brown dorsally, lower plate tipped black; legs yellow. Forewing: length 3.39 mm., width 0.90 mm., venation pale yellow, black areas as in Text-figure 18. Hindwing: venation similar to that in Text-figure 8.

Host-plant: Not known.

Type locality: Tenompok, 1460m. Jesselton, 30 mi. E., British North Borneo.

Type: Holotype ♀ on slide labelled "British N. Borneo, Tenompok, 1460m. Jesselton, 30 mi. E., ii 10-19 1959, T. C. Maa, Collector, BISHOP"; in the collection of the B. P. Bishop Museum, Hawaii.

GLYCASPIS (BOREIOGLYCASPIS) BORNEENSIS, sp. nov.

General colour (dried specimen): yellow.

Female. Head: width 0.68 mm.; vertex: along suture 0.29 mm., width 0.34 mm., yellow; genal processes: length 0.44 mm., yellow; ocular sclerites pronounced; antennae: length 1.20 mm., segs. 1 to 6 yellow, segs. 7 and 8 suffused pale brown, seg. 9 dark brown, seg. 10 black. Pronotum: width 0.59 mm., yellow. Prescutum and scutum: yellow. Scutellum: yellow, with anterior edge slightly convex anteriorly. Meta-scutellum, metanotum and post-metanotum: yellow. Abdomen: yellow; genital seg. yellow. Forewing: length 3.17 mm., width 0.88 mm. (Text-fig. 19), venation pale yellow, wing with yellow suffusion posterior to vein M. Hindwing: venation similar to that in Text-figure 8.

Host-plant: Not known.

Type locality: Tenompok, 1460m. Jesselton, 30 mi. E., British North Borneo.

Type: Holotype female on slide labelled "British N. Borneo, Tenompok, 1460m. Jesselton, 30 mi. E., ii 2-4, 1959, T. C. Maa, Collector, BISHOP"; in the collection of the B. P. Bishop Museum, Hawaii.

GLYCASPIS (BOREIOGLYCASPIS) PENANGENSIS, sp. nov.

General colour (dried specimen): Yellow, with abdomen brown and blue.

Female. Head: width 0.88 mm.; vertex: along suture 0.37 mm., width 0.49 mm., yellow; ocular sclerites not pronounced; genal processes: length 0.44 mm., yellow, slightly paler than vertex; antennae: length 2.10 mm., segs. 1 and 2 yellow, segs. 3 to 6 suffused pale brown with each seg. darker distally, segs. 7 to 9 slightly darker with seg. 9 brown, seg. 10 almost black. Pronotum: width 0.68 mm., yellow. Prescutum and scutum: yellow. Scutellum: yellow, with anterior edge prominently convex anteriorly (Text-fig. 22). Meta-scutellum: yellow. Metanotum: yellow suffused pale blue. Post-metanotum: pale yellow. Abdomen: seg. 1 yellow, remainder brown dorsally with posterior edge of each seg. suffused pale blue; anterior edge of anal aperture black, genital seg. yellow. Forewing: length 3.20 mm., width 1.17 mm. (Text-fig. 20), suffused honey-colour, darker toward posterior edge; venation yellow. Hindwing: venation as in Text-figure 21.

Host-plant: Not known.

Type locality: Island of Penang.

Type: Holotype ♀ on slide labelled "Island of Penang, Baker"; in the collection of the B. P. Bishop Museum, Hawaii.

This species is distinguishable from *G. (B.) forcipata* by the distinctively convex edge of the scutellum.

GLYCASPIS (BOREIOGLYCASPIS) FORCIPATA (Crawford), comb. nov.

(= *Epipsylla forcipata* Crawford 1917, p. 167, fig. 2.)

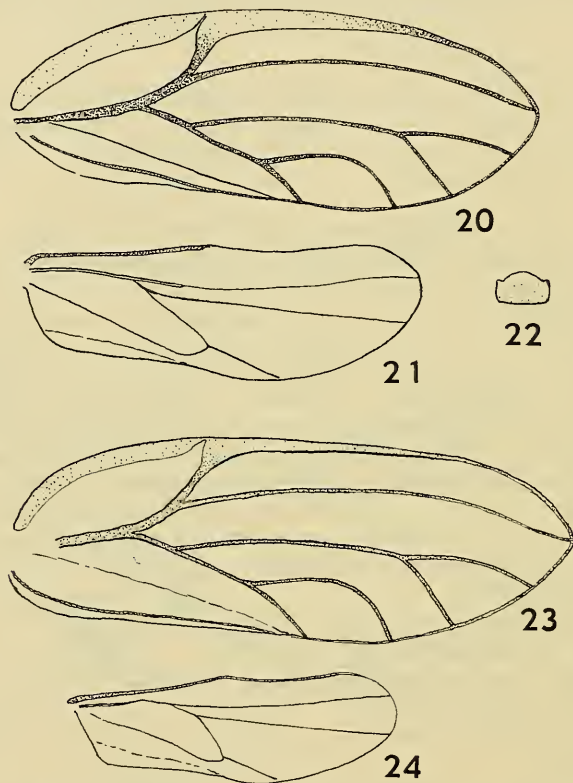
The type series of this species was placed in the collection of the United States National Museum during the 1940s (personal communication, D. L. Crawford, 1963).

In the original description of the species, Crawford gives the data: "Palawan, Puerto Princesa (Baker) 3 males & 5 females". The 1 ♀ and 2 ♂♂ from this series of eight specimens, forwarded on loan, are apparently of the eight that were before Crawford when he wrote the description, and of that eight, three are males and five females as Crawford indicated. These specimens are apparently the co-type series, and each bears an additional label with the data "1943 Colln., D. L. Crawford".

There are 30 additional specimens with the same collection data as the co-types of *forcipata*, but with a "C. F. Baker collection, 1927" label instead of the "1943 Colln., D. L. Crawford" label. Of this series of specimens, 2 ♂♂ and 2 ♀♀ were forwarded for study.

From an examination of the aedeagus and claspers of each male specimen from each of the above label-data series, it has been determined that both groups are *Glycaspis forcipata*.

From the original description (in German) of the genus *Epipsylla* Kuwayama 1908 in which it is stated "pterostigma fehlt" (i.e., pterostigma absent) it is clear that this species does not belong in that genus, and it is here placed in the genus *Glycaspis*. A description is given to include morphological features of the species not given in the original description by Crawford, and because of the poor condition of the type series specimens, this must necessarily be a composite description based on the lectotype ♂, the paralectotype ♂ and the paralectotype ♀ which were forwarded for study, and which were stated to be the better specimens.



Figs 20, 21. Wings of *G. (B.) penangensis*, sp. nov.

Fig. 22. Scutellum of *G. (B.) penangensis*, sp. nov.

Fig. 23. Forewing of female, *G. forcipata*.

Fig. 24. Hindwing of male, *G. forcipata*.

Lectotype male (here designated). Head: pale orange; width 0.81 mm.; vertex: along suture 0.29 mm., width 0.42 mm.; genal processes: length 0.46 mm., slightly divergent for more than half their length; ocular sclerites not pronounced; antennae: length 2.04 mm. Pronotum: width 0.57 mm., pale orange. Prescutum and scutum: pale orange. Scutellum: pale orange, anterior edge almost straight. Meta-scutellum, metanotum and post-metanotum: pale orange. Abdomen: pale orange, segs. 2 and 3 with a small dark brown medio-dorsal mark; claspers and aedeagus (Text-fig. 26) pale orange with a variable number of black pegs on internal face of each clasper. Length of 2-jointed aedeagus: (lectotype) distal portion 0.110 mm., proximal portion 0.205 mm., total length 0.315 mm., (paralectotype) distal portion 0.119 mm., proximal portion 0.212 mm., total length 0.331 mm.; distal segment of proctiger as long as proximal seg. (Text-fig. 13). Forewing: venation as in Text-figure 23. Hindwing: venation as in Text-figure 24.

The black pegs on the internal faces of the claspers are variable in number (8 to 12) in *G. forcipata*.

Paralectotype female. Head: width 0.85 mm., pale orange; vertex: along suture 0.34 mm., width 0.49 mm.; genal processes: length 0.49 mm., contiguous except at distal tips; antennae: length 2.07 mm., segs. 1 to 9 yellow, with distal tips of segs. 5 to 9 pale brown, seg. 10 black. Pronotum: width 0.71 mm., pale orange. Prescutum and scutum: pale orange. Scutellum, meta-scutellum and area between: pale orange; anterior edge of scutellum almost straight. Metanotum and post-metanotum: pale orange. Abdomen: pale orange, segs. 2 and 3 with a small pale brown medio-dorsal mark; genital segment pale orange. Forewing: length 3.37 mm., width 1.20 mm. (Text-fig. 23).

Host-plant: Not known.

Type locality: Puerto Princesa, Palawan Id., Philippine Is.

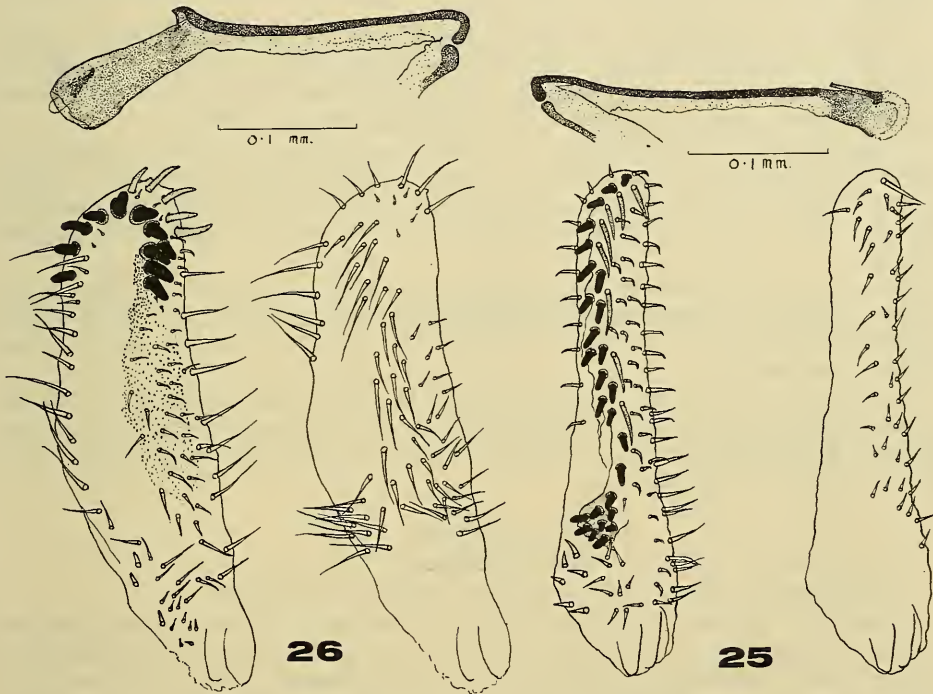


Fig. 25. Male aedeagus and claspers of *G. (B.) melaleucae*, sp. nov. Inner surface (left) and outer surface (right) of claspers.

Fig. 26. Aedeagus and claspers of lectotype male, *G. forcipata*.

Types: (a) Lectotype ♂ on slide labelled "P. Princesa, Palawan, Baker, 1943 Colln. D. L. Crawford", in the collection of the U.S. National Museum, Washington, D.C., U.S.A. (b) Paralectotype ♂ on slide labelled "P. Princesa, Palawan, Baker, 1943 Colln. D. L. Crawford", in the U.S.N.M. (c) Paralectotype ♀ on slide labelled "P. Princesa, Palawan, Baker, 4009, 1943 Colln., D. L. Crawford", in the U.S.N.M. (d) There are an additional five paralectotypes (1 ♂, 4 ♀♀), all presumably of the original type series, 1 ♂ and 3 ♀♀, with the label data "P. Princesa, Palawan, Baker, 1943 Colln. D. L. Crawford", and 1 ♀ with label data "C. F. Baker collection 1927, 4009, *Epipsylla forcipata* Crawford" in the U.S. National Museum, but which were not examined by the writer.

The lectotype ♂, 1 paralectotype ♂ and 1 paralectotype ♀ examined have been labelled as such by the writer, and Miss L. Russell, who is in charge of the psyllids

in the U.S. Department of Agriculture, Washington, D.C., has labelled as paralectotypes the remaining type-series dried specimens (i.e., 1 ♂, 4 ♀♀).

Other specimens examined: A female (dried specimen) labelled "P. Princesa, Palawan, Baker", in the collection of the B. P. Bishop Museum, appears to be *G. forcipata*. Coloration of specimens in the other subgenera of *Glycaspis* is not a reliable characteristic on which the species may be differentiated. This specimen, with considerable brown coloration, bears a brown area on the anterior edge of the prescutum each side of the median area, the marks being continued anteriorly to beneath the pronotum; the scutum bears a narrow brown medio-dorsal longitudinal stripe, and a diffused narrow brown stripe each side diverging posteriorly. These three stripes continue for the total length of the scutum. Lateral to these stripes and separated from them by a narrow golden-yellow area is a paler, more diffused and broader brown longitudinal stripe for the length of the scutum. The scutellum, meta-scutellum and area between are suffused pale brown. From the specimens examined, coloration of this species appears to be variable.

Two ♂♂ on slides and 3 ♀♀ (dried specimens) labelled "Philippines, Pasig, Balabac Id., Mar. 4, 1957, Yoshio Kondo, Collector" have been examined, and 1 ♂ on slide and 3 ♀♀ (dried spec.) are in the collection of the B. P. Bishop Museum. One ♂ on slide, labelled as above, has been placed in The Australian Museum, Sydney.

From the U.S.N.M. collection, 1 ♂ on slide, and 1 ♂, 2 ♀♀ (dried specimens) all labelled "P. Princesa, Palawan, Baker, C. F. Baker 1927 collection" have been examined, and 1 ♂ mounted on a slide and 1 ♀ (dried specimen) are deposited with The Australian Museum. The remaining dried specimens (5 ♂♂, 23 ♀♀) are in the U.S. National Museum.

One ♀ dried specimen of similar colour and characteristics to *G. forcipata* and labelled "British N. Borneo, Tawau Residency, Tawau, xi 19, 1958, T. C. Maa, Collector, BISHOP" has been examined, but at present it is undecided as to which species this specimen represents.

In his "Key to Genera", Crawford (1919) mentions under *E. forcipata* that the species occurs also in the Malay Archipelago, but it is presumed that he examined the specimen now known as *G. penangensis* and that he regarded the specimen to be conspecific with *G. forcipata*.

DISCUSSION.

(a) Species-groups in *Glycaspis* (*Boreioglycaspis*).

There appear to be two groups of species within the subgenus.

Group (i). Species with proximal angle of cell M of forewing commencing just beyond the projection of termination of vein Cu_1 in the posterior border of the wing; forewing wide in proportion to length; apex of wing rounded; tarsal pad approx. $\frac{1}{3}$ the length of tibia; rhinaria on antennal segs. 4 to 6, 8 and 9, with that on seg. 5 atrophied. Species in this Group are *G. penangensis* and *G. forcipata*.

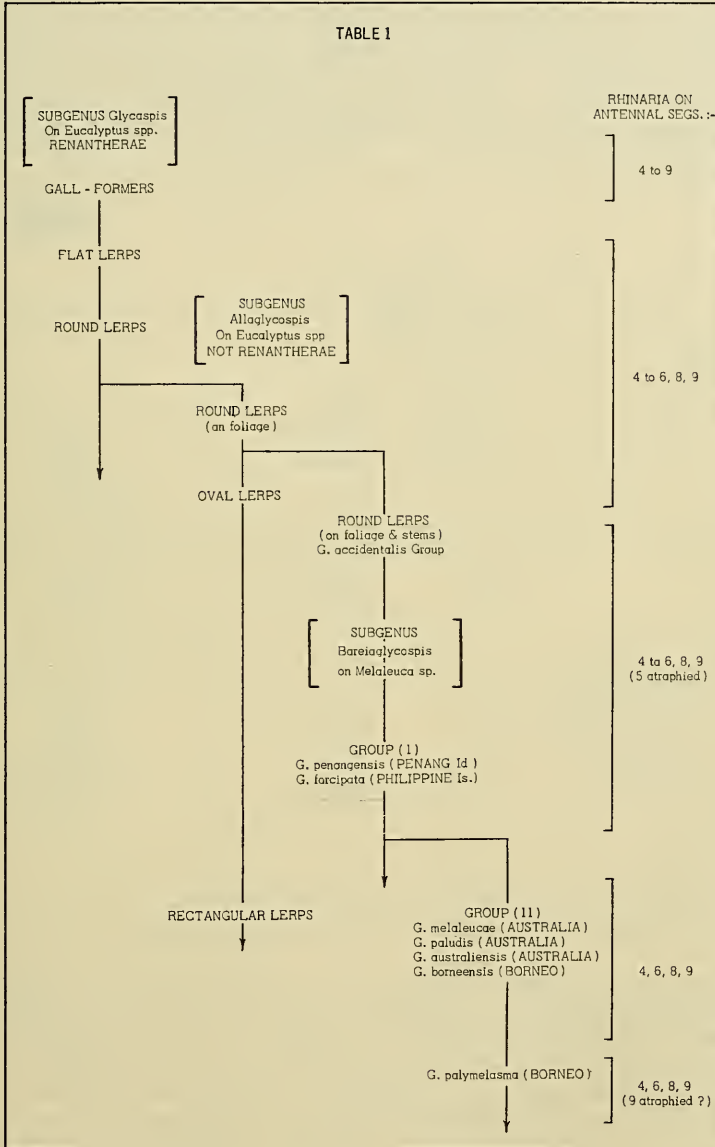
Group (ii). Species with proximal angle of cell M of forewing commencing well beyond the projection of termination of Cu_1 in the posterior border of the wing; wing narrow in proportion to length; apex acutely angular; tarsal pad approx. $\frac{1}{4}$ the length of tibia; rhinaria on antennal segs. 4, 6, 8 and 9 (those on seg. 9 of *G. polymelasma* appear to be atrophied). Species in this Group are *G. melaleuca*, *G. paludis*, *G. australiensis*, *G. polymelasma* and *G. borneensis*, and are considered to be the most recent and specialized in the genus *Glycaspis*.

The ocular sclerites on *G. polymelasma* and *G. borneensis* are narrow and protrude considerably, while those on the other species in the subgenus may be normal or reduced.

(b) Host-plant Associations and Lerps.

It was considered previously (Moore, 1961a, 1961b) that species of the genus *Glycaspis* were confined to *Eucalyptus* spp. hosts.

From extensive preliminary enquiries concerning the possible occurrence of *Eucalyptus* spp. in Borneo, no species of that plant genus are known to be indigenous to that area (Browne, 1955; publications of the British Information Services, Sydney; and personal communication, L. A. S. Johnson of the National Herbarium, Sydney), so that species of *Glycaspis* (*Boreioglycaspis*) occurring on that island apparently do



not require a host association with *Eucalyptus* spp. Two of the Australian species of the subgenus *Boreioglycaspis* were subsequently determined by the writer to breed on *Melaleuca quinquenervia*, but whether all species in this subgenus utilize *Melaleuca* spp. as their host-plant is still in doubt.

Melaleuca spp. also occur in New Caledonia, New Guinea, the Malay Peninsula, Borneo and possibly many other islands to the north of Australia.

There has been no indication that species of *Boreioglycaspis* possess gall-forming or lerp-forming habits as do the species in the other subgenera.

(c) Distribution and Evolutionary Sequence.

No *Glycaspis* spp. were previously known to occur beyond the Australian mainland and Tasmania.

Three species of *Boreioglycaspis* are now known from the eastern coastal region of Australia, one from Penang Island, two from Borneo and one from the Philippine Islands, so that a comparatively recent dispersal of species of the genus northwards from Australia is indicated. No specimens of *Glycaspis* are known from New Guinea (personal communications, 1963, K. L. Taylor of the C.S.I.R.O., and Y. Miyatake of Kyushu University, Japan) although considerable collecting of psyllids has been carried out in that area.



Fig. 27. Distribution of *Glycaspis* (*Boreioglycaspis*) spp.

The number of rhinaria occurring on the antennal segments is regarded as an indication of the comparative evolutionary age of groups of the species concerned (Moore, 1961a). *Glycaspis* spp. constructing foliage galls, and regarded as the most primitive group within the genus, bear a single rhinarium at the apex of each antennal segment 4 to 9 inclusive; those constructing flat, round or oval lerps bear a rhinarium on segs. 4 to 6, 8 and 9, except those species in the *occidentalis* group in which the rhinaria on seg. 5 are atrophied; those constructing rectangular lerps, and regarded as the most recent and specialized group prior to the erection of the new subgenus, bear a rhinarium on segs. 4, 6, 8 and 9; those species in *Glycaspis* (*Boreioglycaspis*) Group (i) bear a rhinarium on segs. 4, 5 (atrophied), 6, 8 and 9, while those species in Group (ii) bear a rhinarium on segs. 4, 6, 8 and 9.

The number of rhinaria occurring on the antennal segments of species in Group (i) thus corresponds with the number occurring on species in the *occidentalis* group of *Glycaspis* (*Alloglycaspis*) (Moore, 1964a). This characteristic, together with the

general shape of the forewing, suggests affinity with them. The number of rhinaria occurring on species in Group (ii) corresponds to the number occurring on specimens constructing rectangular lerps, and they also are of comparatively recent origin. On examination of further specimens of *G. polymelasma*, if the rhinaria on antennal segs. 9 are shown to be consistently atrophied, it would suggest that this species is of the most recent origin of all the known *Glycaspis* spp.

From the host associations of, and the number of antennal rhinaria on, the various species of *Glycaspis*, this psyllid genus is regarded as having originated in Australia with the gall-forming species in *G. (Glycaspis)* which occur on *Eucalyptus* host species contained in the group *Renantherae* of Blakely (1955), as the basic genetic stock, diverging through *G. (Alloglycaspis)* species which occur on *Eucalyptus* host species not contained in the *Renantherae*, to *G. (Boreioglycaspis)* occurring on *Melaleuca* spp. (Table 1), and dispersing northwards at least to the Philippine Islands of Palawan and Balabac (Text-fig. 27).

TABLE 2.
Length of Genal Processes Compared with Vertex Width.

Subgenus.			Range in mm.		Longer.	Equal.	Shorter.
			Genal Processes.	Vertex Width.			
<i>Glycaspis</i>	Galls	.. ..	0.27-0.34	0.42-0.59	—	—	5
	Flat lerps	.. ..	0.29-0.32	0.34-0.39	—	—	2
	Round lerps	.. ..	0.27-0.32	0.32-0.46	—	—	8
Total	.. ..	.. ..	.. ..	.. ..	—	—	15
<i>Alloglycaspis</i>	Round lerps	.. ..	0.20-0.34	0.34-0.39	—	—	11
	Oval lerps	.. ..	0.29-0.37	0.32-0.39	—	1	6
	Rectangular lerps	.. ..	0.34-0.39	0.34-0.39	1	2	—
Total	.. ..	.. ..	.. ..	.. ..	1	3	17
<i>Boreioglycaspis</i>	No lerps						
	(Australia)	.. ..	0.24-0.39	0.29-0.39	—	1	2
	(Penang)	.. ..	0.44	0.49	—	—	1
	(Borneo)	.. ..	0.44-0.51	0.34-0.39	2	—	—
	(Philippines)	.. ..	0.46	0.42	1	—	—
Total	.. ..	.. ..	.. ..	.. ..	3	1	3

Such a dispersal of these insect species northwards from Australia is in contradistinction to the suggested direction of migration of man and other mammals, from the north, southwards into Australia.

The morphological characters of species in the subgenus (*Boreioglycaspis*) which suggest a divergence from *Alloglycaspis* rather than from *Glycaspis* are: (a) The number of antennal rhinaria. (b) Absence of a small spine on each metacoxa (present in *Glycaspis (Glycaspis)* only). (c) Cell Cu of forewing smallest of the three subgenera, with that in *G. (Glycaspis)* the largest. (d) Stem of M+Cu of forewing in *Alloglycaspis* and *Boreioglycaspis* about equal in length in proportion to M and Cu. (e) General wing venation, and particularly the shape of Cu₁ of hindwings. (f) Proportional length of genal processes to vertex width (see Table 2).

CONCLUSION.

It is often impossible to assign the correct female to a male of the same species of *Glycaspis* unless detailed biological observations are made, and then often only on a visual correlation of males and females in copulation. Such observations were particularly important during the initial taxonomic investigations on these species,

for it was not uncommon to find that two species of very similar, if not identical, habits and/or coloration occurred on the one host plant, and males of certain species were separable only on a study of the male claspers and aedeagus mounted on slides. Morphological characters of females, of sufficient reliability to separate the various species, often are not readily recognizable.

One male specimen of *G. (Alloglycaspis)* received on loan from the B. P. Bishop Museum is dealt with in another paper (Moore, 1964b).

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